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Differing planes of nutrition affecting the cytokines of bovine seminal plasma in beef cattle.

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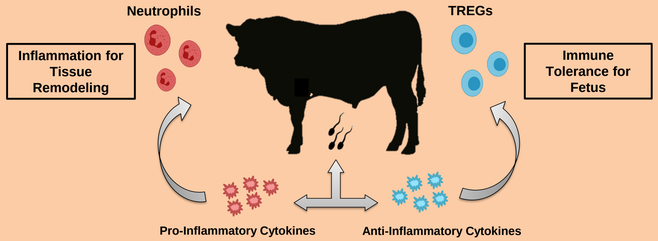
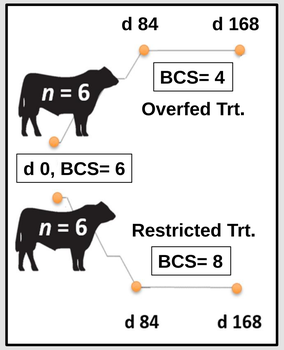
Introduction

- Proper nutrition is critical to maintain peak fertility in bulls to maximize reproductive efficiency and genetic improvement of the calf crop



- Nutrition is known to influence male fertility such as spermatozoa abnormalities and motility, metabolite concentrations and libido[1]
- Inflammatory cytokines within seminal plasma are essential to remodeling of the uterus and tolerance of the fetus[2, 3]
- Nutritional rations used to maintain bulls may affect the inflammatory cytokines within seminal plasma and future reproductive performance

Methodology



Treatments:

- 12 mature Angus bulls were housed individually
- Bulls randomly assigned to one of two treatments:
  - Over-fed (n= 6)
  - Restricted (n= 6)
- Bulls were fed the same ration of 35% ground hay, 35% cracked corn, 20% distillers' grain and 10% soybean meal, at differing volumes to achieve desired nutritional planes

Sample Collection:

- Body weight and BCS were taken every two weeks to monitor nutritional planes
- Blood and ejaculate were collected once a month to determine cytokine profiles within seminal plasma
- Statistical analyses by GLIMMIX procedures in SAS 9.4

Results

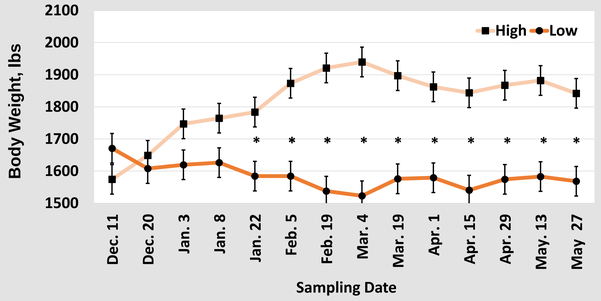


Figure 1. The effects of nutritional levels on body weight within mature Angus bulls

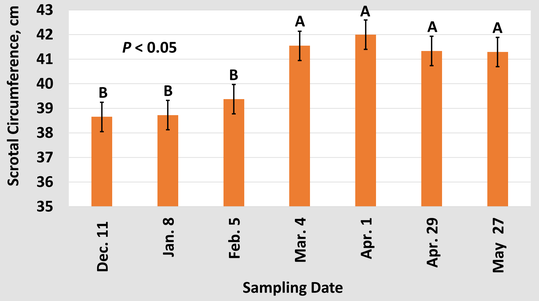


Figure 2. Effects of sampling date on scrotal circumference

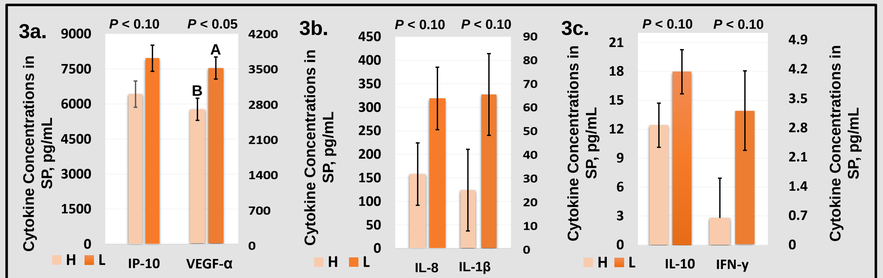


Figure 3. Concentrations of IP-10 and VEGF-α (a), IL-8 and IL-1β (b), and IL-10 and IFN-γ (c) in the seminal plasma of bulls on different nutritional treatments

- No effect of sample date or treatment by sample date detected for IP-10, VEGF-α, IL-8, IL-1β, IL-10 and IFN-γ ($P > 0.05$)
- The cytokines, IP-10, VEGF-α, IL-8, IL-1β, IL-10 and IFN-γ had higher concentrations in the seminal plasma of restricted diet bulls ($P < 0.10$; Figure 3)

- Midpiece defects of spermatozoa morphology were greatest on March 4th (Table 1)
- Highest amount of midpiece defects in spermatozoa appeared in the restricted diet bulls than the overfed (Table 4)

	Dec. 11	Jan. 8	Feb. 5	Mar. 4	Apr. 1	Apr. 29	May 27	*P*-Value	SE
Head	29.99^{C}	34.66^{BC}	39.96^{AB}	43.63^{A}	35.21^{BC}	36.04^{BC}	34.58^{BC}	< 0.01	± 2.30
Midpiece	6.53^{C}	9.61^{BC}	12.29^{B}	28.71^{A}	12.38^{B}	13.89^{B}	14.72^{B}	< 0.01	± 2.02
Total	35.61^{C}	39.44^{C}	49.88^{B}	61.38^{A}	42.58^{C}	42.74^{C}	52.29^{B}	< 0.01	± 2.85

Table 1. Quantification of head, midpiece and total abnormalities in spermatozoa by sampling date. Means without a common letter differ with a *P*-value < 0.05

	Dec. 11		Jan. 8		Feb. 5		Mar. 4		Apr. 1		Apr. 29		May 27		*P*-Value	SE
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low		
Midpiece	6.17^{E}	6.90^{E}	9.30^{CDE}	9.92^{DE}	8.33^{DE}	16.25^{BC}	18.17^{B}	39.25^{A}	8.92^{CDE}	15.79^{BCD}	12.53^{BCDE}	15.25^{BCD}	12.78^{BCDE}	16.7^{BC}	< 0.01	± 3.07

Table 2. Midpiece defects of spermatozoa by sampling date in over-fed and restricted treatments. Means without a common letter differ with a *P*-value < 0.05

	Dec. 11		Jan. 8		Feb. 5		Mar. 4		Apr. 1		Apr. 29		May 27		*P*-Value	SE
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM		
Head	27.58^{F}	32.41^{DEF}	27.75^{F}	41.58^{BCD}	29.58^{EF}	50.33^{AB}	30.5^{EF}	56.75^{A}	25.75^{EF}	44.67^{BC}	27.08^{F}	44.99^{BC}	37.89^{CDE}	31.27^{EF}	< 0.01	± 3.47
Midpiece	7.33^{F}	5.74^{F}	8.92^{EF}	10.30 ^{DEF}	15.25^{CD}	9.33^{DEF}	31.50^{A}	25.92^{AB}	12.33^{DEF}	12.42^{DEF}	8.50^{F}	19.30^{BC}	16.37^{CDE}	13.07^{CDEF}	< 0.05	± 2.89
Tail	1.83^{BC}	0.79^{C}	0.83^{C}	1.66^{BC}	2.25^{ABC}	2.00^{BC}	4.00^{A}	1.83^{BC}	2.42^{ABC}	1.25^{C}	1.50^{BC}	2.63^{ABC}	3.59^{AB}	1.09^{C}	< 0.10	± 0.79

Table 3. The interaction of sampling date by time of day (am vs. pm) on the number of head, midpiece and tail defects in spermatozoa of mature bulls. Means without a common letter differ with a *P*-value < 0.05

Continued Results

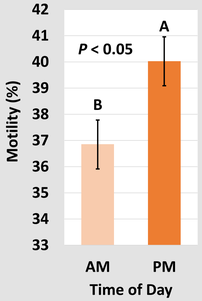


Figure 4. The effect of time of day sampling (AM vs PM) on spermatozoa progressive forward motility

	High	Low	*P*-Value	Pooled SE
Midpiece	10.88^{B}	17.15^{A}	< 0.05	± 1.73

Table 4. The effect of diet levels on middle piece defects in spermatozoa. Means without a common letter differ with a *P*-value < 0.05

	AM	PM	*P*-Value	SE
Head	29.45^{B}	43.14^{A}	< 0.01	± 1.18
Tail	2.35^{A}	1.61^{B}	< 0.05	± 0.36

Table 5. Differences in head and tail defects in spermatozoa between morning and afternoon ejaculate samples. Means without a common letter differ with a *P*-value < 0.05

Conclusions

- BW and BCS followed predicted model by designated treatment
- Scrotal circumference increased after February 5th which may relate to seasonality
- Pro-/anti-inflammatory and angiogenic cytokine concentrations were significantly more expressed with the restricted diet bulls
- Morphology defects were influenced by sampling dates, time collected and treatment
  - Greatest amount of middle spermatozoa defects on March 4th as well as in restricted diet bulls
- Morning ejaculate sample had lower progressive forward motility than afternoon

Acknowledgments

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References

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